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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: March 26, 1997

SUBJECT: Preliminary Ecological Assessment, Old LaSalle Dump, LaSalle, IL

FROM: Ed Karecki, U.S. Fish and Wildlife Service Biologist EK
Technical Support Section

TO: Daryl Owens, Remedial Project Manager

The following preliminary ecological assessment (PEA) is based primarily on the information presented in the following documents:

CERCLA Screening Site Inspection Report, Old LaSalle Dump, prepared by the Illinois Environmental Protection Agency.

11/95 Sediment and Surface water samples

1. Preliminary Problem Formulation

1.1 Environmental Setting

The site is located on approximately 6 acres south of the town of LaSalle. The site is located in the floodplain of the Illinois River on a peninsula which extends into Huse Lake, a backwater lake. The shoreline of the lake is primarily wooded. The site is bounded on the north, west, and south by the lake, and on the east by Route 351. Across route 351 are floodplain wetlands. The Illinois River is located approximately one half mile south of the site.

The Illinois River valley lakes receive heavy use from migratory birds. It is likely that Huse Lake and the surrounding area sustains large numbers of migratory birds and other wildlife. The area also provides potential habitat for the federally endangered bald eagle and Indiana Bat. The lake connects to the Illinois River via a channel at the west end of the lake.

1.2 Contaminants of Concern

Results of chemical analyses of sediment and surface water indicate that disposal activities have potentially caused elevated levels of Aroclor-1248, Aroclor-1254, Aroclor-1260, lead, and zinc in the sediments of the lake. These contaminants are also found at elevated levels in site soils. Aroclor-1221 was not detected in sediments, but was elevated in site soils.

Additional contaminants which are found in site soils and pose a risk of migrating to the lake, through surface migration or groundwater flow, are total polycyclic aromatic hydrocarbons (semivolatiles), pesticides, cadmium, and copper.
Since the Aroclors, lead, and zinc have already migrated to the lake, this preliminary assessment will concentrate on these contaminants.

Lead

Lead is generally not very soluble in water, except under conditions of low pH, low organic content, low suspended solids, and low concentrations of the salts of calcium, iron, manganese, zinc, and cadmium. Under these conditions lead becomes most bioavailable. Lead in surface waters is generally found in the sediments, or in the water surface layer when surface organic materials are present in thin films (ATSDR 1993).

Lead partitions primarily to sediments, but becomes more bioavailable under low pH, hardness, and organic matter content. Lead bioaccumulates in algae, macrophytes and benthic organisms, but the inorganic forms do not biomagnify.

Lead is relatively immobile in moderately acidic to basic soils (pH >5-6) with soil organic matter contents of at least 5% due to sorption to organic matter, ion exchange with clays and hydrous oxides, chelation with humic substances, and formation of insoluble organic lead complexes. Leaching is very slow except under acidic conditions (pH <4-6), or low organic matter content (<5%), or when lead concentrations exceed the soil cation exchange capacity. The main loss of soil lead is by erosion (ATSDR 1993). Soil lead is relatively unavailable to plants, except under acidic conditions, and the majority of the absorbed lead is retained in the root system. Phytotoxicity is rarely observed, probably because of the low availability to plants and internal immobility. The poor translocation of lead to above-ground plant tissues also means that foliar herbivory is not a major route of exposure to soil lead, and that plant growth will not attenuate soil lead (Kabata-Pendias and Pendias 1992). Excessive amounts, however, can reduce photosynthesis, mitosis, and water absorption (Eisler 1988).

Bioconcentration is known to occur, as are interactions with other heavy metals, which may be synergistic, antagonistic, or in some cases beneficial.

Earthworms do not bioaccumulate inorganic lead except under highly acidic conditions, so the main route of exposure for vermivores is incidental soil ingestion (including soil in the worm guts) (Beyer 1990). The toxicity of inorganic lead to earthworms is low, with LOAELs greater than 5,000 and 50,000 mg/kg soil required for inhibition of reproduction and growth, respectively (Edwards and Bohlen 1992). Shrews accumulate lead to a greater extent than voles or mice, and estimated lead intake on contaminated sites may approach the LOAEL for rodent reproductive effects (low to mid 10s mg Pb/kg bw/day) (Shore and Douben 1994). Lead poisoning of birds has been associated with ingestion of lead shot and bioaccumulative organolead compounds, but not with food chain exposure to inorganic lead. There are complex interactions with other contaminants and diet. Lead poisoning in higher organisms primarily affects hematologic and neurologic processes. Potential endpoints include growth reductions and impaired survival (Eisler 1988, ATSDR. 1993).

PCBs (Aroclors)

PCBs tend to concentrate in the sediments and suspended matter of water bodies. PCBs bioconcentrate in the tissues of animals and plants. The tissue concentrations can increase by orders of magnitude moving up the food chain from one trophic level to the next. PCBs are extremely stable compounds and slow to chemically degrade in the environment (ATSDR 1992).

PCBs elicit a variety of effects including skin lesions, wasting syndrome, immunotoxicity, reproductive toxicity, genotoxicity, and liver damage. Birds are more susceptible to the lethal effects than mammals, and the piscivorous birds accumulate higher levels of PCBs than do insectivorous or herbivorous ones. In plants, PCBs exert an inhibitory effect on photosynthesis, cell motility, and appear to also cause somatic mutations in some species. They have a direct toxic effect on algae. Sensitivity to PCBs varies greatly between species, even between species which are closely related (Eisler 1986).

Zinc

Zinc sorbs strongly to soil particles. However, the mobility of zinc in soil depends on the solubility of the speciated forms of the element, and on soil properties such as cation exchange capacity, pH, redox potential, and chemical species present in the soil. Leaching may occur under conditions of low pH and high ionic strength of the leaching solution (ATSDR).

Zinc has its primary effect on zinc-dependent enzymes that regulate RNA and DNA. The pancreas and bone are primary target sites in birds and mammals, the gill epithelium is a primary site in fish. Growth of animal tumors is stimulated by zinc and retarded by zinc deficiency under most conditions. Organozinc compounds have been shown to be mutagenic. Excess zinc is teratogenic to frog and fish embryos. Sensitive terrestrial plants die when zinc soil levels exceed 100 mg/kg. Earthworms have reduced survival when soil levels exceed 470 mg/kg, and the woodlouse has inhibited reproduction at >1600 mg/kg. The most sensitive aquatic species were adversely affected at concentrations between 10 and 25 ug/l. Zinc interactions with other heavy metals which may be synergistic, antagonistic, or in some cases beneficial (Eisler 1993).

2. Preliminary Ecological Effects Evaluation

The primary ecological area of concern is Huse Lake.

Sediment samples collected from the lake from the lake contained elevated levels of Aroclor-1248 (41 mg/kg), lead (2960 mg/kg), and zinc (3820 mg/kg). The level of contamination decreased to no detection for Aroclors, and to near background for lead and zinc, as samples were collected further from the site.

The pattern of contamination suggests that the northeast bay of the lake, or possibly the eastern third of the lake, contains elevated levels of Aroclors, lead and zinc.

3. Risk Calculation

A detailed risk calculation cannot be performed due to lack of site specific information on bioavailability, uptake, and tissue concentrations for ecological receptors. A preliminary risk calculation for sediments indicates a hazard quotient of 27,333 for Aroclor-1248, 95 for lead, and 32 for zinc. A hazard quotient greater than or equal to one indicates the potential for effects to benthic invertebrates (Ontario 1991). The bioaccumulative effects of Aroclors, however, are usually even more evident at higher trophic levels.

4. Recommendations

A full ecological risk assessment should also be performed to determine risk to wildlife and, if necessary, establish cleanup levels.

If you have any questions, or would like to discuss the site further, please call me at (312) 353-3202. Please also take a moment to fill out the attached critique sheet and return it to Steve Ostrodka (SRT-4J).

cc: S. Ostrodka
    B. Sypniewski

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